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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/611,978	07/03/2003	Hideo Fujiwara	239658US23X	4244

22850 7590 11/22/2005

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EXAMINER

CHEN, TIANJIE

ART UNIT PAPER NUMBER

2652

DATE MAILED: 11/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/611,978

Applicant(s)

FUJIWARA ET AL.

Examiner

Tianjie Chen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 October 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-39 is/are pending in the application.
- 4a) Of the above claim(s) 9-12 and 30-38 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8, 13-29 and 39 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

Non-Final Rejection

Election/Restrictions

1. Applicant's election without traverse of Species III with claims 1-10, 12-29, and 39 in the reply filed on 10/25/2005 is acknowledged.

Applicant asserts that claims 1 and 19 are generic. Examiner finds that claim 19 is not generic. Since claim 19 recites "a thin non-magnetic confining (CC)-layer structure configured to separate the free and pinned layers" in lines 5-6; this feature does not read on Species II drawn from Fig. 7.

Claims 9, 10, and 12 recite "an interference spin asymmetry coefficient" and "bulk spin asymmetry coefficient." In Applicant's disclosure these two coefficients are only directed to the non-elected species I and II. Therefore, Claims 9, 10, and 12 should be withdrawn.

Finally claims 1-8, 13-29, and 39 are under examination.

Drawings

2. Figures 1 and 2 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 15 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 15 recites "an exchange length," which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

4. Claims 13, 14, 16-20, 23, and 24-29 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term "the power of 1.5 of the thickness measured in nano-meters" in claims 13, 14, 19, 20, 23, 24, 28, and 29 is not used in the art. The term is indefinite because the specification does not clearly redefine the term.

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The term “the power of 1.5 of the thickness measured in nano-meters” in claims 13, 14, 19, 20, 23, 24, 28, and 29 is not used in the art. The meaning of this term is not defined. Therefore, it renders indefiniteness.

Claims 16 and 25 recite: “a pair of CC-layer structures are located on both sides across the free layer structure or the pinned layer whose conducting parts are located in a cascade manner, and at least the inner edge to edge distance of a projection of the conducting parts of the CC-layers forming at least one of the current paths through at least one of the free layer structure and the pinned layer onto the layer plane is made greater than the thickness of at least one of the free layer structure and the pinned layer.” As stated in Applicant’s Specification p. 18, this feature is a feature recited from A. C. Reilly et al, J. Magn. Mater., Vol. 195, L269-L274 (1999). Nowhere in this Application indicates that this is a feature of this invention.

Claims 17, 18, 26, and 27 recite “the length of at least one of the current paths through at least one of the free layer structure and the pinned layer structure is greater than a half of a spin diffusion length in at least one of the free layer structure and the pinned layer structure and is smaller than 3 times as large as a spin diffusion length;” and “the length of at least one of the current paths through at least one of the free layer structure and the pinned layer structure is greater than the spin diffusion length in at least one of the free layer structure and the pinned layer structure and is smaller than 2 times as large as the spin diffusion length of the current paths;” respectively. However, according to Applicant’s disclosure p. 20, line 19 to p. 18, line 1; these feature were recited from K. Nagasaka et al J. Magn. Soc. Jpn. Vol. 25, 807-811 (2001). Nowhere indicates that this is a feature of this invention.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1-5, 8, 13-15, 19-24, 28, 29, and 39 are rejected under 35 U.S.C. 102(e) as being anticipated by Carey et al (US 6,686,068).

Claim 1, Carey shows a CPP spin-valve element (Column 4, lines 65-67) formed on an inherent substrate in Fig. 3 including: a free layer structure including at least one ferromagnetic layer 308 (Column 6, line 7); a pinned layer structure including at least one ferromagnetic layer 304 or 312 (Column 6, lines 9-10), the free layer is inherently magnetically softer than the pinned layer; a thin non-magnetic spacer layer structure 306 (Column 6, line 11) configured to separate the free layer and the pinned layer to prevent a magnetic coupling between the free and pinned layer structures, and to allow an electric current to go there through; and wherein at least two current-confining (CC) layer structures 306 and 310 including at least two parts having significantly different current conductivities are incorporated therein (Column 6, lines 10-24).

Claim 2, Carey et al the pinned layer structure comprises a ferromagnetic layer 312 exchange coupled with an antiferromagnetic layer 314 (Column 6, lines 12-13).

Claim 3, Carey et al shows in Fig. 5 that the CC-layer structure includes a mosaic structure of conducting and insulating parts (Column 6, lines 14-24).

Claim 4, Carey et al shows that the mosaic structure includes metal and oxide (Column 5, lines 17-27).

Claim 5, Carey et al shows that the metal is selected from the group consisting of Ag, Al, Au, Co, Cr, Cu, Fe, Mg, Mn, Nb, Ni, Pd, Pt, Ta, Ti, V, Zr and their alloys and the oxide is selected from the group consisting of the oxides of Al, Co, Cr, Cu, Fe, Mg, Mn, Nb, Ni, Pd, Si, Ta, Ti, V, and Zr (Column 5, lines 17-27).

Claim 8, Carey et al shows that one of the CC-layer structures 306 is located in the vicinity of the free layer structure 308 and another of the CC-layer structures 310 is located in the vicinity of the pinned layer structure 312 (Fig. 3).

Claims 13 and 14, Carey et al shows that the width of the confined current paths of the CC-layer structures is about 0.7 times the width of the layer (Since the conductor has volume percentage of 50%, column 5, line 22-24), the width is 50nm (Column 5, lines 50-54). The confined current paths of the CC-layer structures is about $TL=35\text{nm}$. which is 50nm greater than the power of 1.5 of the thickness measured in nano-meters of the ferromagnetic layers which include or lie next to the Cc-layer structures.

Claim 15, Carey et al shows that at least one confined-current path is formed within every flux path.

Claim 19, as described above, Carey et al shows a CPP spin-valve element formed on a substrate including: a free layer structure including at least one ferromagnetic layer; a pinned layer structure including at least one ferromagnetic layer, the free layer is magnetically softer than the pinned layer; and a thin non-

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magnetic current confining CC-layer structure configured to separate the free and pinned layers, to prevent a substantial magnetic coupling between the free and pinned layer structures, and to allow an electric current to go through the confined current paths; wherein the width of the confined current paths of the CC-layer structure is about 35nm.

Claim 20, as described above, Carey et al shows that the width of the confined current paths of the CC-layer structure is about 35 nm.

Claim 21, as described above, Carey et al shows a CPP spin-valve element formed on a substrate including: a free layer structure including at least one ferromagnetic layer; a pinned layer structure including at least one ferromagnetic layer, the free layer is magnetically softer than the pinned layer; and a thin non-magnetic current confining (CC)-layer structure configured to separate the free and pinned layers, to prevent a substantial magnetic coupling between the free and pinned layer structures, and to allow an electric current to go through the confined current paths; wherein another CC-layer structure is incorporated therein.

Claim 22, as described above, Carey et al shows the another CC-layer structure is placed across at least one of the free layer and the pinned layer.

Claims 23 and 24, as described above, Carey et al shows that the width of the confined current paths of the CC-layer structures is about 35 nm.

Claim 28, as described above, Carey et al shows a CPP spin-valve element formed on a substrate including: a free layer structure including at least one ferromagnetic layer; and a pinned layer structure including at least one ferromagnetic layer, the free layer is magnetically softer than the pinned layer; wherein at least one CC-layer structure incorporated therein, which is configured to separate the free and

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pinned layers and to allow an electric current to go through the confined current paths. the width of at least one of the confined current paths of the at least one CC-layer structure is about 35nm.

Claim 29, Carey et al shows that the width of at least one of the confined current paths of the Cc-layer structure is about 35 nm.

Claim 39, Carey et al shows the CC-layer structures are fabricated.

A "product by process" claim is directed to the product per se, no matter how actually made, see *In re Hirao*, 190 USPQ 15 at 17 (footnote 3 CCPC, 5/27/76); *In re Brown*, 173 USPQ 685 (CCPA 5/18/72); *In re Luck*, 177 USPQ 523 (CCPA, 4/26/73); *In re Fessmann*, 180 USPQ 324 (CCPA, 1/10/74); *In re Thorpe*, 227 USPQ 964 (CAFC, 11/21/85). The patentability of the final product in a "product by process" claim must be determined by the product itself and not the actual process and an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. In instant case, "with a lithography technique using a focused ion beam or an electrochemical scanning probe" is a process related limitation, which gains no weight in determining patentability.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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6. Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carey et al in view of Moodera et al (US 5,835,314).

Claims 6 and 7, Carey et al shows that the mosaic structure includes metal and high resistive material such as Alumina, does not mention nitride.

Moodera et al shows that in making magnetic head as high resistive material, Alumina and AlN can be used alternatively (Column 3, lines 18-20). One of ordinary skill in the art would have been motivated to include AlN as the material for making the mosaic structure.

7. Claims 16-18, and 25-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carey et al in view of AAPA (Applicant Admitted Prior Art).

Claims 16 and 25; AAPA shows in P. 18 "a pair of CC-layer structures are located on both sides across the free layer structure or the pinned layer whose conducting parts are located in a cascade manner, and at least the inner edge to edge distance of a projection of the conducting parts of the CC-layers forming at least one of the current paths through at least one of the free layer structure and the pinned layer onto the layer plane is made greater than the thickness of at least one of the free layer structure and the pinned layer;" and it would provide high magnetoresistance ΔR .

One of ordinary skill in the art would have been motivated to apply this relation into Carey et al's device for obtaining high magnetoresistance ΔR .

Claim 17, Carey et al shows in Fig. 3 that a pair of CC-layer structures 306 and 310 are located on both sides across the free layer structure 308, whose conducting parts are located in a cascade manner.

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Claim 17,18, 26, and 27; AAPA shows in Applicant's Specification p. 17 the length of at least one of the current paths through at least one of the free layer structure and the pinned layer structure is greater than the spin diffusion length in at least one of the free layer structure and the pinned layer structure and is smaller than 3/or 2 times as large as the spin diffusion length of the current paths. Since AAPA show it is an optimized number, one of ordinary skill in the art would have been motivated to apply this relation into Carey et al's for optimizing the performance of the device.

Conclusion

8. The prior art made of record in PTO-892 Form and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tianjie Chen whose telephone number is 571-272-7570. The examiner can normally be reached on 8:00-4:30, Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hoa Nguyen can be reached on 571-272-7579. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


TIANJIE CHEN
PRIMARY EXAMINER